

# **TRANSMISSION APPARATUS FOR MOBILE COMMUNICATION TERMINAL**

## **BACKGROUND OF THE INVENTION**

### **1. Field of the Invention**

The present invention relates to a mobile communication terminal, and particularly to an apparatus for controlling power of a mobile communication terminal.

### **2. Description of the Background Art**

In a terminal of a mobile communication system, an internal temperature of the terminal has large influence on its performance and used hours of a battery. Because of this, the terminal includes a temperature detecting device and an amplifying device therein, and thus can check the internal temperature of the terminal, and adjust transmission power according to the temperature, through these devices.

Figure 1 is a block diagram of a transmission apparatus of a general mobile communication terminal.

As shown therein, the general mobile communication terminal includes a modem 110 for outputting an intermediate frequency (IF) signal and an auto gain control (AGC) signal; a gain controller 120 for adjusting a gain of the IF signal outputted from the modem 110, according to the AGC signal; a frequency mixer 130 converting the adjusted IF signal into a radio frequency (RF) signal; a drive amplifier 140 for amplifying the RF signal; a filter 150 for bandwidth filtering the amplified RF signal; a power amplifier 160 for sufficiently amplifying power of an

output signal of the filter 150 as much as the output signal can be transmitted to a receiving side through the air; and a thermistor 170 for detecting an internal temperature of the terminal and applying the detecting result to the modem 110.

For convenience sake of explanation, hereinafter, the frequency mixer 130,  
5 the drive amplifier 150, and a power amplifier 160 will be referred to a transmission signal processing block.

In the background art constructed as above, the thermistor 170 receives a predetermined voltage corresponding to the internal temperature of the terminal, converting the received voltage into a DC voltage, and applying the DC voltage to  
10 the modem 110. Then, the modem 110 estimates an internal temperature of the terminal based on a level of the applied DC voltage, and compares the estimated temperature with a reference temperature. Through this comparison, the modem 110 generates a predetermined AGC signal so that the terminal can maintain a proper temperature thereof, and applies the AGC signal to the gain controller 120.

15 The gain controller 120 adjusts power of the IF signal outputted from the modem 110, according to the applied AGC signal.

Through the process above, the mobile communication terminal controls the gain of the transmission power so as to prevent its internal temperature from increasing more than the reference temperature. In the background art above,  
20 considering that characteristics of internal devices of the terminal is changed according to a temperature, the thermistor 170 is mounted in the vicinity of internal devices of the terminal. In addition, using the thermistor 170, the internal temperature of the terminal is compensated.

However, since the thermistor is implemented as an independent circuit  
25 and the internal temperature of the terminal is affected by various environmental

factors, the temperature detected by the thermistor does not always correspond to actual power of the transmission apparatus.

That is, since a resistance characteristic value of the thermistor is changed according to change of the internal temperature of the terminal and thereby changing the DC voltage level, a compensation value which actually controls power, may not be correct. If power is outputted more than a reference level by incorrect compensation, a battery is rapidly consumed.

## **SUMMARY OF THE INVENTION**

Therefore, an object of the present invention is to provide a transmission apparatus of a mobile communication terminal implemented so that a modem, a gain controller and a power controlling circuit have one loop construction.

To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein, there is provided a transmission apparatus for a mobile communication terminal including a modem for outputting an intermediate frequency (IF) signal and an AGC signal; a gain controller for adjusting a gain of the IF signal according to the AGC signal; a power controlling circuit for adjusting the AGC signal according to temperature change of the terminal, and applying the adjusted AGC signal to the gain controller; and a transmission signal processing block converting the IF signal whose gain is adjusted, into a radio frequency (RF) signal, amplifying and bandwidth filtering the converted RF signal, then amplifying power of the RF signal as much as the RF signal can reach a receiving side, and emitting the amplified RF signal.

Preferably, the transmission signal processing block includes a mixer for converting the signal whose gain is adjusted, into a RF signal; a drive amplifier for amplifying the RF signal; a filter for bandwidth filtering the amplified signal; and a power amplifier for sufficiently amplifying power of the signal as much as the  
5 filtered signal can be transmitted to a receiving side through the air.

Preferably, the power controlling circuit is positioned between the modem and the gain controller.

Preferably, the power controlling circuit includes a thermistor whose one side is connected with the modem, and whose other side is connected with the  
10 gain controller; and a resistor whose one side is earthed, and whose other side is connected with the thermistor in parallel.

Preferably, the power controlling circuit includes a first resistor whose one side is connected with the modem; a second resistor whose one side is connected with the first resistor, and whose other side is connected with the gain controller;  
15 and a thermistor whose one side is earthed, and whose other side is connected with the first and second resistors in parallel.

Preferably, the power controlling circuit includes an AGC adjuster for adjusting an AGC signal of the modem according to temperature change of the terminal, and applying the adjusted AGC signal to the gain controller; and a signal  
20 amplifier for amplifying the AGC signal applied to the gain controller at a voltage level as much as the modem can recognize, and transmitting the amplified AGC signal to the modem.

Preferably, the AGC adjuster includes a thermistor whose one side is connected with the modem, and whose other side is connected with the gain  
25 controller; and a resistor whose one side is earthed, and whose other side is

connected with the thermistor in parallel.

Preferably, the AGC adjuster includes a first resistor whose one side is connected with the modem; a second resistor whose one side is connected with the first resistor, and whose other side is connected with the gain controller; and a  
5 thermistor whose one side is earthed, and whose other side is connected with the first and second resistors in parallel.

The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the  
10 accompanying drawings.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

The accompanying drawings, which are included to provide a further  
15 understanding of the invention and are incorporated in and constitute a unit of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

In the drawings:

Figure 1 is a block diagram showing a transmission apparatus of the  
20 general mobile communication terminal;

Figure 2 is a block diagram showing a transmission apparatus of a mobile communication terminal according to one embodiment of the present invention;

Figures 3a and 3b are drawings showing a construction of a power controlling circuit of Figure 2;

25 Figure 4 is a block diagram showing a transmission apparatus of a mobile

communication terminal according to another embodiment of the present invention; and

Figure 5 is a drawing showing a construction of a signal amplifier of Figure 4.

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## **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

In the present invention, a power controlling circuit is mounted between the modem and the gain controller so that the power controlling circuit can control transmission power of the transmission apparatus by directly adjusting an AGC signal of the modem according to temperature change of the transmission apparatus of the terminal.

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

Figure 2 is a block diagram showing a transmission apparatus of a mobile communication terminal.

As shown therein, a transmission apparatus of a mobile communication terminal according to one embodiment, includes: a modem 210 for outputting an intermediate frequency (IF) signal and an AGC signal; a gain controller 240 for adjusting a gain of the IF signal according to the AGC signal; a power controlling circuit 220 for adjusting the AGC signal according to temperature change of the terminal and applying the adjusted AGC signal; and a transmission signal processing block 200 for converting the IF signal, whose gain is adjusted, into a radio frequency (RF) signal, amplifying and bandwidth filtering the converted RF

signal, then amplifying power of the RF signal as much as being able to reach a receiving side, and emitting the amplified RF signal.

The transmission signal processing block 200 includes a frequency mixer 250 for converting the signal whose gain is adjusted, into a RF signal; a drive amplifier 260 for amplifying the RF signal; a filter 270 for bandwidth filtering the amplified signal; and a power amplifier 280 for amplifying power as much as the output signal of the filter 270 can reach a receiving side through the air. Constructions and functions of the transmission signal processing block 200 are the same as those of the conventional block.

The power controlling circuit 220 adjusts an AGC signal applied to the gain controller 240 from the modem 210. That is, the power controlling circuit 220 adjusts the AGC signal immediately according change of an internal temperature of the terminal, using a device such as a thermistor varying a characteristic value of resistance according to an input voltage. The gain controller 240 compensates a gain of the IF signal outputted from the modem, according to the adjusted AGC signal.

The IF signal whose gain has been compensated by the gain controller 240, is transmitted to the transmission signal processing block 200 and then processed in the same manner as in the background art.

Figures 3a and 3b are drawings showing a construction of a power controlling circuit according to one embodiment of the present invention.

As shown in Figure 3a, a power controlling circuit 220 according to one embodiment includes a thermistor ( $VR_1$ ) whose one side is connected with the modem 210, whose other side is connected with the gain controller 240; and a resistor ( $R_2$ ) whose one side is earthed, and whose other side is connected with

the thermistor (VR<sub>1</sub>) in parallel.

As shown in Figure 3b, the power controlling circuit 220 may include a resistor (R<sub>4</sub>) whose one side is connected with the modem 210; a resistor (R<sub>5</sub>) whose one side is connected with the resistor (R<sub>4</sub>), and whose other side is  
5 connected with the gain controller 240; and a thermistor (VR<sub>3</sub>) whose one side is earthed, and whose other side is connected with the resistors (R<sub>4</sub> and R<sub>5</sub>) in parallel.

A thermistor (VR<sub>1</sub> or VR<sub>3</sub>) used in the power controlling circuit 220 is a kind of variable resistor, and has a characteristic value of 63kΩ. Since, the  
10 characteristic value (63kΩ) of the resistance, changes along with change of an internal temperature of the terminal, a voltage of an AGC signal having passed through the power controlling circuit 220 is greater (or smaller) than a primary voltage value. According to the AGC signal having passed through the power  
controlling circuit 220, the gain controller 240 adjusts a power gain of the IF signal  
15 outputted from the modem 210. Consequently, the transmission apparatus of the terminal can precisely control transmission power according to change of an internal temperature of the terminal.

Figure 4 is a block diagram showing a transmission apparatus of a mobile communication terminal according to another embodiment of the present invention.

20 As shown therein, a transmission apparatus of a mobile communication terminal according to another embodiment of the present invention, is the same as that according to one embodiment of the present invention, except a power controlling circuit 230,

The power controlling circuit 230 according to another embodiment of the  
25 present invention includes an AGC adjuster 288 for adjusting an AGC signal

applied from the modem 210, and applying the adjusted AGC signal to the gain controller 240; and a signal amplifier 224 for amplifying the AGC signal applied to the gain controller 240 at a voltage level as much as the modem 210 can recognize, and then transmitting the amplified AGC signal to the modem 210.

5           The AGC adjuster 228 adjusts an AGC signal (hereinafter, will be referred to a first AGC signal) applied to the gain controller 240 from the modem 210. That is, the AGC adjuster 228 adjusts the first AGC signal immediately according to change of the internal temperature of the terminal, using a device such as a thermistor varying a resistance value according to an input voltage.

10           The signal amplifier 224 is a kind of amplifying circuit receiving an actual AGC signal (will be referred to a second AGC signal) applied to the gain controller 240 and amplifying the second AGC signal at a voltage level as much as the modem 210 can recognize, and is implemented, using an operational amplifier. (Refer to Figure 5) The amplified second AGC signal is applied to the modem 210  
15           so that the modem 210 can monitor the second AGC signal applied to the gain controller 240.

          The modem 210 generates a certain AGC signal while monitoring the second AGC signal. That is, the modem 210 estimates an internal temperature of the terminal based on the second AGC signal, and compares the estimated  
20           temperature with a reference temperature. Through this comparison, the modem 210 generates a certain AGC signal (a first AGC signal) so that the terminal can maintain a proper temperature thereof, and applies the generated AGC signal to the power controlling circuit 230.

          The AGC adjuster 228 has the same construction as the power controlling  
25           circuit 220 according to one embodiment. That is, as shown in Figure 3a, the AGC

adjuster 228 includes a thermistor (VR<sub>1</sub>) and a resistor (R<sub>2</sub>). Also, as shown in Figure 3b, the AGC adjuster 228 may include a resistor (R<sub>4</sub>), a resistance (R<sub>5</sub>) and a thermistor (VR<sub>3</sub>).

In the present invention, an AGC signal of a modem is precisely adjusted, and the adjusted AGC signal is applied to gain control in real time, so that a consumption amount of battery due to a loss of a current can be remarkably reduced.

Also, in the present invention, a modem, a gain controller and a power controlling circuit has one loop construction so that efficiency of power control can be improved. Also, a modem monitors an actual AGC signal applied to the gain controller so that a gain of a transmission power is more precisely controlled. .

As the present invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its spirit and scope as defined in the appended claims, and therefore all changes and modifications that fall within the metes and bounds of the claims, or equivalence of such metes and bounds are therefore intended to be embraced by the appended claims.